CLAIMS

What is claimed is:

1. A loading system for loading an elongated strand of food product of a given diameter on a transport conveyor, comprising a first loading conveyor extending along a forward travel direction from an upstream entrance end to a downstream exit end, a second loading conveyor spaced above said first loading conveyor by a gap having a dimension less than or equal to said given diameter such that said strand is frictionally engaged by both of said first and second loading conveyors to pull said strand into said gap and such that said strand is conveyed from said upstream entrance end to said downstream exit end by an indexed drive and discharged at said downstream exit end to said transport conveyor.

2. The loading system according to claim 1 comprising a plurality of pairs of said first and second loading conveyors conveying a plurality of respective said strands in parallel along said forward travel direction from respective parallel entrance ends to respective parallel exit ends, and a transfer ramp extending forwardly and downwardly from said parallel exit ends to said transport conveyor, said transfer ramp comprising a plurality of channels, one for each said strand, and transferring said strands in parallel to said transport conveyor.

3. The loading system according to claim 2 wherein said transfer ramp has an upstream end at said parallel exit ends of said first loading conveyors, and has a downstream end at said transport conveyor, said upstream end of said transfer ramp having a first lateral width transverse to said forward travel direction, said downstream end of said transfer ramp having a second lateral width transverse to said forward travel direction, said second lateral width being less than said first lateral width.

4. The loading system according to claim 3 wherein said channels extend forwardly and downwardly and laterally inwardly from respective ramp entrance ends to respective ramp exit ends.

5. The loading system according to claim 2 wherein said transfer ramp has an upstream end at said parallel exit ends of said first loading conveyors, and has a downstream end at said transport conveyor, wherein said transport conveyor comprises a plurality of spaced apart hangers each presented separately to and traversing past said downstream end of said transfer ramp, each hanger traveling in a direction parallel to said forward travel direction as it traverses past said downstream end of said transfer ramp, each hanger comprising a rod extending along a direction parallel to said downstream end of said transfer ramp and transverse to said forward travel direction, each rod carrying a plurality of said strands draped thereover from respective said channels.

6. The loading system according to claim 5 wherein each said strand of food product comprises a casing having tubular segments serially joined by pinched connection segments, and comprising a plurality of said drives, one for each said conveyor pair, wherein each said drive is indexed to drape a given number of said tubular segments vertically downwardly and then upwardly between adjacent rods in a given hang pattern.

7. The loading system according to claim 6 wherein the number of said tubular segments of a given strand extending downwardly rearwardly from a given rod is a hang count greater than or equal to 3, and less than or equal to 5, and the number of tubular segments extending upwardly to the next rod is equal to said hang count.

8. The loading system according to claim 7 wherein the number of tubular segments draped between adjacent rods further includes a lower tubular segment extending horizontally between said downwardly extending tubular segments and said upwardly extending tubular segments.

9. The loading system according to claim 6 wherein each said drive is indexed at a fixed speed synchronized to said transport conveyor.

10. The loading system according to claim 6 wherein each said drive is indexed to travel a fixed distance equal to the number of said tubular segments in the hang pattern of the respective strand.

11. The loading system according to claim 10 comprising a sensor for each said drive sensing said indexed tubular segments of the respective said strand and providing feedback to the respective said drive to adjust said fixed travel distance to compensate for slipping of the respective strand along said loading system.

12. The loading system according to claim 6 wherein each said drive is a servo motor.

13. The loading system according to claim 5 wherein each said hanger comprises an inverted T-bar hanging from said transport conveyor in pivoted relation, said T-bar having a downwardly depending trunk and a lateral horizontal cross-bar at the bottom thereof, and comprising a camming ramp below said transfer ramp and engaging and pivoting each T-bar upwardly and rearwardly to widen the gap to the next leading T-bar while said next leading T-bar is being loaded with strands from respective said channels of said transfer ramp.

14. The loading system according to claim 1 wherein said second loading conveyor extends along said forward travel direction from an upstream end to a downstream end.

15. The loading system according to claim 14 wherein the length of said second loading conveyor along said forward travel direction is less than the length of said first loading conveyor along said forward travel direction.

16. The loading system according to claim 14 wherein said downstream end of said second loading conveyor is spaced upstream along said travel direction from said downstream exit end of said first loading conveyor.

17. The loading system according to claim 14 wherein said upstream end of said second loading conveyor is spaced upstream of said upstream entrance end of said first loading conveyor.

18. The loading system according to claim 14 wherein said each of said upstream and downstream ends of said second loading conveyor is spaced upstream of each of respective said upstream and downstream ends of said first loading conveyor.

19. The loading system according to claim 18 wherein said upstream end of said second loading conveyor is spaced rearwardly of said upstream end of said first loading conveyor by a first offset distance, and said downstream end of said second loading conveyor is spaced rearwardly of said downstream end of said first loading conveyor by a second offset distance, and wherein said second offset distance is greater than said first offset distance.

20. The loading system according to claim 1 comprising an entrance guide spaced upstream of said gap and guiding said strand into said gap.

21. The loading system according to claim 20 wherein said entrance guide comprises an idle roller spaced rearwardly and downwardly of said upstream end of said first loading conveyor, wherein said strand extends upwardly to said idle roller and then upwardly and forwardly to said upstream end of said first loading conveyor.

22. The loading system according to claim 20 wherein said entrance guide is accessible to an operator at an operator loading station, and wherein said first and second loading conveyors comprise respective first and second upstream rotary conveyor pulleys, and comprising a faceplate blocking access to said rotary conveyor pulleys from said operator loading station, and wherein said entrance guide comprises an inlet through said faceplate.

23. The loading system according to claim 22 wherein said inlet is an annular bushing extending through said faceplate and having a frustoconical inner surface providing an inlet cone having a wider entrance mouth tapering to a narrower exit mouth.

24. The loading system according to claim 22 wherein said second rotary conveyor pulley is rearward of said first rotary conveyor pulley, and said

inlet is rearward of said first rotary conveyor pulley and below said second rotary conveyor pulley.

25. The loading system according to claim 24 wherein said entrance guide further comprises an idle roller spaced rearwardly and downwardly of said inlet, wherein said strand extends upwardly to said idle roller and then upwardly and forwardly to said inlet and then forwardly to said upstream end of said first loading conveyor.

26. The loading system according to claim 20 wherein said entrance guide comprises the combination of an inlet cone spaced rearwardly of said upstream end of said loading conveyor and an idle roller spaced rearwardly and downwardly of said inlet cone, wherein said strand extends upwardly to said idle roller and then upwardly and forwardly to said inlet cone and then forwardly to upstream end of said first loading conveyor.

27. The loading system according to claim 1 wherein said first and second loading conveyors comprise respective first and second upstream rotary drive pulleys each driven by a direct drive connection from a motor.

28. The loading system according to claim 27 wherein the same said motor drives both of said first and second drive pulleys.

29. The loading system according to claim 28 wherein said motor is a servo motor and provides said indexed drive.

30. The loading system according to claim 28 wherein said motor drives said first and second pulleys at the same rotational speed and in opposite rotational directions.

31. The loading system according to claim 30 wherein said first drive pulley comprises a first driven gear on a first shaft rotational about a first axis, said second drive pulley comprises a second driven gear on a second shaft rotational about a second axis, and comprising a motor having an output drive shaft rotating about a third axis and having a drive gear on said drive shaft engaging at least one of said first and second driven gears.

32. The loading system according to claim 31 wherein said drive gear comprises a worm gear extending between and engaging each of said first and second driven gears on distally opposite sides of said worm gear.

33. The loading system according to claim 31 wherein said first and second axes extend parallel to each other and transversely to said forward travel direction, and said third axis extends transversely to said first and second axes.

34. The loading system according to claim 33 wherein said third axis extends obliquely relative to said forward travel direction.

35. The loading system according to claim 31 wherein said first and second axes are spaced along a projection line extending transversely therebetween, and wherein said third axis intercepts said projection line.

36. The loading system according to claim 35 wherein said third axis transversely intercepts said projection line.

37. The loading system according to claim 36 wherein said third axis transversely intercepts said projection line at a point between said first and second driven gears.

38. The loading system according to claim 31 wherein said first and second axes extend parallel to each other and transversely to said forward travel direction and are spaced along a projection line extending transversely therebetween and obliquely relative to said forward travel direction.

39. The loading system according to claim 38 wherein said third axis extends obliquely relative to said forward travel direction.

40. The loading system according to claim 39 wherein said projection line extends obliquely upwardly and rearwardly, and said third axis extends obliquely upwardly and forwardly.

41. The loading system according to claim 40 wherein said projection line and said third axis intersect each other.

42. The loading system according to claim 40 wherein said projection line and said third axis are transverse to each other.

43. The loading system according to claim 1 comprising a plurality of pairs of said first and second loading conveyors conveying a plurality of respective said strands in parallel along said forward travel direction from respective parallel entrance ends to respective parallel exit ends, a plurality of motors, one dedicated for each said pair, said first and second conveyors of each said pair comprising respective first and second rotary drive pulleys each driven by a direct drive connection from a respective said dedicated motor.

44. The loading system according to claim 43 wherein each said conveyor pair is driven by its respective said dedicated motor independently of the remaining said conveyor pairs.

45. The loading system according to claim 14 wherein said first and second loading conveyors comprise respective first and second conveyor belts, and comprising a roller cam engaging one of said belts at a location between said upstream and downstream ends, said roller cam being adjustably movable toward and away from the other of said belts to control said dimension of said gap.

46. The loading system according to claim 45 wherein said second conveyor belt has a bottom side facing downwardly and engaging said strand of said food product, and has a top side facing upwardly, and wherein said roller cam engages said top side of said second conveyor belt above said gap.

47. The loading system according to claim 46 wherein said first and second loading conveyors comprise respective first and second upstream rotary pulleys, said second pulley being spaced rearwardly and upwardly from said first pulley, and wherein said roller cam is forward of said second pulley.

48. The loading system according to claim 47 wherein said roller cam is vertically aligned with said first pulley to locate said gap at said first pulley and forward of said second pulley.

49. The loading system according to claim 14 wherein said first and second loading conveyors comprise respective first and second conveyor belts each trained around respective upstream and downstream pulleys, each belt

having an inner surface engaging its respective said pulley, and having an outer surface facing oppositely to said inner surface and engaging said strand of food product.

50. The loading system according to claim 49 wherein both of said belts are of self-lubricating hygienic material.

51. The loading system according to claim 50 wherein said belts are plastic.

52. The loading system according to claim 51 wherein said belts are thermoplastic.

53. The loading system according to claim 49 wherein said inner surface of at least one of said belts and at least one of its respective said pulleys are cogged.

54. The loading system according to claim 49 wherein said outer surface of at least one of said belts has first and second raised lips extending along said forward travel direction and laterally spaced by a surface having a concave curvature complemental to said strand of food product for guiding and cradling said strand through said gap and traversal along said forward travel direction.

55. The loading system according to claim 1 wherein said strand of food product comprises a casing having tubular segments serially joined by pinched connection segments, and said drive is indexed to drape a given number of said tubular segments in a given hang pattern on said transport conveyor.

56. The loading system according to claim 55 wherein said drive is indexed at a fixed speed synchronized to said transport conveyor.

57. The loading system according to claim 55 wherein said drive is indexed to travel a fixed distance equal to the number of tubular segments in said hang pattern.

58. The loading system according to claim 57 comprising a sensor sensing said indexed tubular segments and providing feedback to said drive to

adjust said fixed travel distance to compensate for slipping of said strand along said loading system.

59. The loading system according to claim 55 wherein said drive is a servo motor.

60. A method for loading an elongated strand of food product of a given diameter on a transport conveyor, comprising providing a first loading conveyor extending along a forward travel direction from an upstream entrance end to a downstream exit end, providing a second loading conveyor spaced above said first loading conveyor by a gap having a dimension less than or equal to said given diameter, frictionally engaging said strand with both of said first and second loading conveyors and pulling said strand into said gap and conveying said strand from said upstream entrance end to said downstream exit end by an indexed drive, and discharging said strand at said downstream exit end to said transport conveyor.

61. The method according to claim 60 comprising providing a plurality of pairs of said first and second loading conveyors, conveying a plurality of respective said strands in parallel along said forward travel direction from respective parallel entrance ends to respective parallel exit ends, providing a transfer ramp and extending said transfer ramp forwardly and downwardly from said parallel exit ends to said transport conveyor, providing said transfer ramp with a plurality of channels, one for each strand, and transferring said strands in parallel along said transfer ramp to said transport conveyor.

62. The method according to claim 61 comprising transferring said parallel strands along said channels forwardly and downwardly and laterally inwardly from respective ramp entrance ends to respective ramp exit ends.

63. The method according to claim 61 comprising providing said transfer ramp with an upstream end at said parallel exit ends of said first loading conveyors, and a downstream end at said transport conveyor, providing said transport conveyor with a plurality of spaced apart hangers, presenting each said hanger separately to and traversing past said downstream end of said transfer

ramp, each hanger traveling in a direction parallel to said forward travel direction as it traverses past said downstream end of said transfer ramp, providing each said hanger with a rod extending along a direction parallel to said downstream end of said transfer ramp and transverse to said forward travel direction, and draping a plurality of said strands over each said rod from respective said channels.

64. The method according to claim 63 comprising providing each strand of food product as a casing having tubular segments serially joined by pinched connection segments, providing a plurality of said drives, one for each said conveyor pair, and indexing each said drive to drape a given number of tubular segments vertically downwardly and then upwardly between adjacent rods in a given hang pattern.

65. The method according to claim 64 comprising indexing each said drive at a fixed speed synchronized to said transport conveyor.

66. The method according to claim 64 comprising indexing each said drive to travel a fixed travel distance equal to the number of said tubular segments in the hang pattern of the respective strand.

67. The method according to claim 66 comprising sensing said indexed tubular segments of the respective said strand for each said drive and providing feedback to the respective said drive, and adjusting said travel distance to compensate for slipping of the respective strand along said loading system.

68. The method according to claim 60 comprising providing an entrance guide spaced upstream of said gap, and guiding said strand into said gap through said entrance guide.

69. The method according to claim 68 comprising providing said entrance guide as an idle roller spaced rearwardly and downwardly of said upstream end of said first loading conveyor, and feeding said strand upwardly to said idle roller and then upwardly and forwardly to said upstream end of said first loading conveyor.

70. The method according to claim 68 comprising providing said entrance guide accessible to an operator at an operator loading station, providing said first and second loading conveyors with first and second rotary conveyor pulleys, providing a faceplate blocking access to said rotary conveyor pulleys from said operator loading station, providing said entrance guide as an inlet through said faceplate, and feeding said strand through said inlet through said faceplate and into said gap.

71. The method according to claim 68 comprising providing said entrance guide with a combination of an inlet cone spaced rearwardly of said upstream end of said loading conveyor and an idle roller spaced rearwardly and downwardly of said inlet cone, and feeding said strand upwardly to said idle roller and then upwardly and forwardly to said inlet cone and then forwardly to said upstream end of said loading conveyor.

72. The method according to claim 60 comprising providing said first and second loading conveyors with respective first and second upstream rotary drive pulleys, driving each of said pulleys with a direct drive connection from a motor, and driving both of said first and second drive pulleys with the same said motor.

73. The method according to claim 60 comprising providing a plurality of pairs of said first and second loading conveyors, conveying a plurality of respective said strands in parallel along said forward travel direction from respective parallel entrance ends to respective parallel exit ends, providing a plurality of motors, one dedicated for each said pair, providing said first and second conveyors of each said pair with respective first and second rotary drive pulleys, and driving said drive pulleys by a direct drive connection from a respective said dedicated motor.

74. The method according to claim 73 comprising driving each said conveyor pair by its respective dedicated motor independently of the remaining said conveyor pairs.

75. The method according to claim 60 comprising providing said second loading conveyor extending along said forward travel direction from an upstream end to a downstream end, providing said first and second loading conveyors with respective first and second conveyor belts, engaging one of said belts with a roller cam at a location between said upstream and downstream ends, and controlling said dimension of said gap by adjustably moving said roller cam toward and away from the other of said belts.

76. The method according to claim 75 wherein said second conveyor belt has a bottom side facing downwardly, and comprising engaging said strand of food product with said bottom side of said second conveyor belt, said second conveyor belt having a top side facing upwardly, and comprising engaging said roller cam against said top side of said conveyor belt above said gap.

77. The method according to claim 76 comprising providing said first and second loading conveyors with respective first and second upstream rotary pulleys, spacing said second pulley rearwardly and upwardly from said first pulley, and engaging said top side of said second conveyor belt with said roller cam forwardly of said second pulley.